ceae. The plates are remarkably good reduced reproductions of those of the *Bryologia Europaea*, as are most of the figures, which sometimes cover a half page or more. The figures original in this work are well drawn and illustrate critical features of various species. The comments of the author will also be very helpful to those for whom the book is intended. All in all, the work is admirable both in conception and in execution. It is difficult to understand how it can be sold profitably at the very low price asked.—C. R. B.

THE FACT that an unhealthy or wounded tree is neither ornamental nor serviceable dominates every page of the little volume entitled *The tree doctor*.[9] The titles of the three sections into which the book is divided are : tree surgery; ornamental; landscaping and floriculture. In the first part, where, how, and when to prune a tree are discussed, while the two latter titles deal with the problems of landscape gardening. The book is written in a somewhat sensational and extravagant style, and it contains numerous statements in regard to the physiology and pathology of plants that will seem queer to the scientific reader. The volume is intended, however, for the layman, and it will doubtless stimulate him to a better care of his fruit-bearing and ornamental trees. —C. D. HOWE.

C. F. MILLSPAUGH[10] has issued the Compositae of his flora of Yucatan. In addition to the plates, there are numerous excellent cuts from drawings by Miss Agnes Chase, showing a portion of the inflorescence or a single head natural size, the achene magnified, and a cross-section of the achene at its greatest diameter. The display of the family is somewhat remarkable in that there are no large genera among the 58 enumerated. The new species in old genera are only three in number (Parthenium, Salmea, Encelia), and a new genus (*Plagiolophus*) of Verbesinae is described by J. M. Greenman.— J. M. C.

THE SIXTH FASCICLE of Dalle Torre and Harms's *Genera Siphonogamarum*[11] has just appeared, including genera from Gentianaceae (6492. Geniostemon) to Acanthaceae (7937. Mimulopsis).—J. M. C.

NOTES FOR STUDENTS.

IWANHOFF[12] finds that proteids are not destroyed in the course of alcoholic fermentation, because the decomposition of the sugar forms substances which inhibit the action of the proteolytic enzymes.—C. R. B.

[9] DAVEY, JOHN, The tree doctor, a book on tree culture illustrated profusely with photographs. 8vo. pp. 88. *figs. 167*. Akron, Ohio: Published by the author. 1902. $1.00.

[10] MILLSPAUGH, C. F., Plantae Yucatanae (regionis antillanae). Plants of the insular, coastal, and plain regions of the peninsula of Yucatan, Mexico. Fasc. 2. Compositae (with Agnes Chase). Pp. 85–151. *pls. 9* and numerous text cuts. Field Columb. Mus. Bot. Series 3: no. 2. April 1904.

[11] DALLA TORRE, C. G. DE, and HARMS, H., Genera Siphonogamarum ad systema Englerianum conscripta. Fasc. 6, pp. 401–480. Leipzig: Wilhelm Engelmann, 1904. *M*4.

[12] IWANHOFF, L., Ueber das Verhalten der Eiweissstoffe bei der alkoholischen Gärung. Ber. Deutsch. Bot. Gesells. **22**: 203–206. 1904.

BENECKE[13] has presented a concise review and discussion of several of the more recent researches upon the influence of metallic salts upon organisms. He well points out that what is most needed now is a study of the effect of a large number of salts upon the same organism, so that comparison may be instituted. He also calls attention to the fact that the effect of salts upon other processes than growth (*e. g.*, photosynthesis, transpiration, etc.) will need to be studied.—B. E. LIVINGSTON.

OLIVER,[14] in studying certain unreferred seeds of the Permocarboniferous, has found that those named Trigonocarpus and Polylophospermum, both being of the radially symmetrical type (Radiosperms), agree essentially in structure with Stephanospermum and the Trigonocarpons of the English Coal Measures, having the broad pollen-chambers, the tracheal mantle, and the differentiated testa. The probabilities are becoming stronger that many of these numerous unreferred seeds belonged to that anatomically differentiated group Cycadofilices, and it remains to be seen how much of it will pass over into the recently proposed group Pteridosperms.[15]—J. M. C.

ILTIS[16] has investigated the influence of light and darkness on the rate of growth of the adventitious roots of a number of water plants. His results show that the growth of the roots observed is decidedly accelerated by darkness. The mean result of experiments on the roots of five water plants, viz: *Myriophyllum proserpinacoides*, *M. verticillatum*, *Lysimachia nummularia*, *Ranunculus aquatilis*, and *Elodea canadensis*, though varying considerably among themselves, shows the growth in length in darkness is approximately twice that of similar roots in the light. This is a greater acceleration for darkness than has been obtained for soil roots.—W. B. MACCALLUM.

APOGAMOUS PROTHALLIA[17] of Nephrodium, showing remarkable nuclear changes that appear to be related to the apogamy in question, are described in a preliminary note by Farmer, Moore, and Miss Digby. Binucleate cells are frequently present in young prothallia and in such cases at least one contiguous cell is destitute of a nucleus. Nuclei were also seen passing from one cell into another and a fusion of nuclei may then take place, though the two nuclei often remain separated for some time. Mitoses in apogamous

[13] BENECKE, W. VON, Einige neuere Untersuchungen über den Einfluss von Mineralsalzen auf Organismen. Bot. Zeitung **62**[2]: 113–126. 1904.

[14] OLIVER, F. W., Notes on *Trigonocarpus* Brongn. and *Polylophospermum* Brongn., two genera of palaeozoic seeds. New Phytol. **3**: 96–104. *pl. 2*. 1904.

[15] See BOT. GAZ. **37**: 236–238. 1904.

[16] ILTIS, HUGO, Ueber den Einfluss von Licht und Dunkel auf das Längenwachstum der Adventivwurzel bei Wasserpflanzen. Bei. Deutsch. Bot. Gesells. **21**: 508–517. 1903.

[17] FARMER, J. B., MOORE, J. E. S., and DIGBY, MISS L., On the cytology of apogamy and apospory. I. Preliminary note on apogamy. Proc. Roy. Soc. London **71**: 453–457. 1903.

regions show a much larger number of chromosomes than those of the ordinary cells of the prothallium. The whole process is regarded as a kind of irregular fertilization and the young plantlet as an homologously differentiated embryo.—C. J. CHAMBERLAIN.

A CYTOLOGICAL STUDY[18] of malignant growths known as "carcinomata" and "sarcomata" has shown nuclear details resembling those in normal reproductive cells. The cells of the diseased tissue for a time resemble those of early stages in sporogenous tissue; then a varying number of cells, situated behind the advancing edge of the diseased tissue, enlarge and undergo the heterotypic mitosis, showing the loops or rings characteristic of the heterotypic mitosis of normal reproductive cells, and in several cases the numbers were approximately halved. Subsequent divisions behind this zone show homœotypic mitoses, but the reduced number of chromosomes is retained. This paper is a preliminary note and does not attempt to make a full application of the results.—C. J. CHAMBERLAIN.

FARMER and MOORE[19] are reinvestigating the reduction of chromosomes and believe they can reconcile such divergent views as those of Häcker and Brauer. They claim that observers, with the exception of Schaffner, have not apprehended the mode of formation of the heterotypic chromosomes. They believe that synapsis is a phase specially intercalated in the reproductive cycle, and that in it the number of chromosomes is reduced by their adhesion in pairs. The longitudinal division following synapsis is that characteristic of ordinary somatic division, the separation of the halves being deferred until the next mitosis. They believe that the heterotype division is different in kind from ordinary mitoses. The full paper, now in preparation, will give the evidence upon which their conclusions rest.—C. J. CHAMBERLAIN.

THE VASCULAR SYSTEM of *Pteris aquilina*, though examined by every elementary student, has been very generally misunderstood. DeBary followed Hofmeister in considering the peripheral ring of strands to be cortical bundles, but Jeffrey[20] pointed out that these represent the stele, while the two central or medullary strands are of late origin. The petiolar strands are derived from both inner and outer strands of the rhizome. In a recent paper by Tansley and Lulham[21] the exact connection of the petiolar strands with

[18] FARMER, J. B., MOORE, J. E. S., and WALKER, C. E., On the resemblances exhibited between the cells of malignant growths in man and those of normal reproductive tissues. Proc. Roy. Soc. London **72**: 499–504. 1903.

[19] FARMER, J. B., and MOORE, J. E. S., New investigations into the reduction phenomena of animals and plants. Proc. Roy. Soc. London **72**: 104–108. *figs. 6.* 1903.

[20] JEFFREY, E. C., The morphology of the central cylinder in the angiosperms. Trans. Canadian Inst. **6**: 1–40. *pls. 7–11.* 1900.

[21] TANSLEY, A. G., and LULHAM, R. B., The vascular system of the rhizome and leaf-trace of *Pteris aquilina* and *Pteris incisa integrifolia*. New Phytologist **3**: 1–17. *figs. 59.* 1904.

those of the rhizome has been traced. The writers derive the condition seen in *P. aquilina* from the simpler one presented by *P. incisa integrifolia*, in which the infoldings of the petiolar stele are continued down into the rhizome as infoldings, while in *P. aquilina* the infoldings become medullary strands in the rhizome.—M. A. CHRYSLER.

THE STIMULATION OF GROWTH by poisons has been studied by Kanda.[22] He finds that seedlings of *Pisum sativum* in water culture are not stimulated by $CuSO_4$ at any concentration. The salt is toxic at a concentration of $M/1{,}000{,}000{,}000$. When these seedlings are grown in water which contains traces of $ZnSO_4$ they are stimulated to greater growth, the optimum concentration lying between $M/10{,}000{,}000$ and $M/1{,}000{,}000{,}000$. This salt is toxic at $M/1{,}000{,}000$ concentration. In a similar way NaF is found to stimulate Pisum seedlings when at a concentration of $5M/10{,}000$ to $5M/100{,}000$. NaF is toxic at about $5M/1{,}000$ concentration. When grown in pots of soil and watered with solutions of $CuSO_4$ and ZnSO , seedlings of *Vicia Faba* and *Pisum sativum* show a marked stimulation at a certain concentration. Of course the amount of salt cannot here be measured; the fact of stimulation alone is noted.—B. E. LIVINGSTON.

ACCORDING TO RESEARCHES OF GRÜSS,[23] it is possible to demonstrate in yeast cells, and in a glycerin extract of them, a substance which splits free oxygen from such molecules as hydrogen peroxid, potassium permanganate, and the oxidation products of di- and tetramethylparaphenylendiamin chlorid, etc. It is possible to destroy the oxidase in yeast by treatment with aceton, after which treatment the power to split oxygen from the above bodies is still exhibited to a marked degree. The author was able to separate oxidase from this new body (which he terms peroxidase) by their unequal rates of diffusion. If into a mixture of yeast cells rubbed up in glycerin strips of filter paper are hung, it is found that the peroxidase ascends in the paper much faster than does the oxidase, so that the paper at a certain level is found to give no reaction for the latter enzyme, while the presence of peroxidase was easily demonstrated. Grüss thinks the new body is probably a true enzyme, of opposite action to that of oxidase.—B. E. LIVINGSTON.

THE NOTABLE LENGTHENING which takes place in the stipe of Taraxacum during the ripening of the seed has often been commented upon, especially by the older ecologists. Miyake[24] has made daily measurements of the growing stipe in numerous specimens of several varieties of Taraxacum.

[22] KANDA, MASAYASU, Studien über die Reizwirkung einiger Metallsalze auf das Wachsthum höherer Pflanzen. Jour. Coll. Sci. Imp. Univ. Tokyo **19**: [article 13]. pp. 37. *pl. 1.* 1904.

[23] GRÜSS, J., Peroxydase, das Reversionsenzym der Oxydase. Ber. Deutsch. Bot. Gesell. **21**: 356–364. 1903.

[24] MIYAKE, K., Ueber das Wachstum des Blütenschaftes von Taraxacum. Beihefte Bot. Centralbl. **16**: 403–414. *pl. 1.* 1904.

He finds three well-marked stages in the development: (1) a period of accelerating growth extending from the appearance of the stipe to the middle of the flowering period, 7–10 days; (2) a period of slow growth including the last half of the flowering and the development of the seeds, 6–8 days; (3) a second period of active elongation reaching its maximum 1–2 days before the dispersal of the seeds and continuing for a day or two thereafter, 7–10 days. The greatest daily growth noted in the first stage was 8.9^{cm}, and in the third stage 10^{cm}. The curve representing the "grand period of growth" thus presents the anomaly of having two well-marked maxima. There seems to be no indication that external factors are responsible, as every individual measured, both in Japan and America, gave essentially the same results.—G. H. SHULL.

THE MEMOIR OF F. W. OLIVER[25] "On the structure and affinities of Stephanospermum," read before the Linnean Society in February of 1903, has just appeared. In consequence of the fact that during this long interval between the reading of the paper and its publication a remarkable number of discoveries have been made bearing upon the matters of general morphological interest presented by this paper, its information is not so fresh and striking as it would have been a year ago.[26] In addition to the details in reference to the two species of Stephanospermum considered, attention is called to the fact that the presence of a pollen chamber is a remarkably uniform character of paleozoic seeds. That this pollen chamber was associated with fertilization by means of swimming sperms seems to be no less evident, and it "reached its zenith in Permo-Carboniferous times. Its decline Professor Oliver correlates "with the evolution of pollen-tubes;" but it must be remembered that there is every reason to believe that pollen-tubes were not originally developed as sperm-carriers. The whole paper is full of interesting details to the morphologist interested in the phylogeny of seed-plants. —J. M. C.

BOWER[27] has published the results of a study of a single specimen of the very interesting Sumatran *Ophioglossum simplex*, only three plants of which were found by Ridley in 1897. "The almost complete suppression of any trace of a sterile portion of the frond, and the consequent reduction of the plant to the very simplest elements, is the most peculiar feature in this species" is a statement from Ridley's description. Bower found that an external examination revealed no part which could be compared with the sterile lobe or sporophyll of other Ophioglossaceae, and this was confirmed by

[25] OLIVER, F. W., On the structure and affinities of *Stephanospermum* Brongniart, a genus of fossil gymnosperm seeds. Trans. Linn. Soc. London. Bot. II. **6**: 361–400. *pls. 41–44.* 1904.

[26] See BOT. GAZ. **37**: 236. 1904.

[27] BOWER, F. O., *Ophioglossum simplex* Ridley. Annals of Botany **18**: 205–216. *pl. 15.* 1904.

sections. Accordingly, in his judgment, the "sterile lobe" is completely suppressed. It seems to follow either that the plant never had a subtending sporophyll or that the sporophyll is entirely abortive. The former alternative would support the view of the primitive character of the Ophioglossaceae, proposed by Campbell in comparing the "spike" of Ophioglossum with the sporogonium of Anthoceros. Bower is inclined to accept the second alternative, and to see in *O. simplex* an abortion of the sterile lamina, regarding the Ophioglossaceae as derivatives from a lycopod type. He finds a descending series in the related *O. pendulum*, *O. intermedium*, and *O. simplex*, in which there is a decrease of the sterile leaf, and the extreme condition of *O. simplex* he thinks "may be attributed to the presence of mycorhiza, which makes nutrition of the large spike still possible in the dense, wet forest in which it grows, notwithstanding that the usual assimilating organ is functionally non-existent."—J. M. C.

HANNIG [28] has studied the growth of embryos in nutrient solutions outside of the embryo sac. The embryos used were those of *Raphanus sativus*, *R. Landra*, *R. caudatus*, and *Cochlearia danica*, and were isolated at various stages in their development from the one-celled condition. The object was to determine their ability to utilize various organic foods. In the cell-sap squeezed out of the plant and sterilized the embryos refused to grow. In nutrient salt solutions they also failed to live, despite the fact that all possess plenty of chlorophyll. In cultures of 10 per cent. cane sugar in a nutrient salt solution embryos consisting of a single cell at the end of the suspensor soon die, but much older embryos grow well. These never assume the curved position that they present in the embryo sac but always remain straight. They soon lose their chlorophyll, but make and store in their leaves large amounts of starch, but are unable to form proteid. Young plants taken from this sugar solution and planted in sand and watered with a nutrient salt solution at once become green and grow and fruit normally, which brings out the interesting fact that the embryo is not hindered from its normal development by removal from the embryo-sac. In solutions of 1 per cent. sugar and varying amounts up to 10 per cent. of peptone the embryos are unable to produce proteid and the protoplasm finally disappears, as does also the chlorophyll. With asparagin as a source of nitrogen only the older embryos of Cochlearia came to maturity; all the rest died, as they also did in leucin. With glycocoll, which is a favorable source of nitrogen for fungi, no growth was obtained, nor on tyrosin. In a decoction of Raphanus plants only a temporary growth was obtained. Several other nitrogen compounds were used, but in no case could any increase in the total amount of nitrogen in the embryos be obtained.—W. B. MACCALLUM.

[28] HANNIG, E., Zur Physiologie pflanzlicher Embryonen. I. Ueber die Cultur von Cruciferen-Embryonen ausserhalb des Embryosacks. Bot. Zeitung **62**[1]:45–80. *pl. 3*. 1904.

WILLIAMS,[29] in continuing his studies in the Dictyotaceae, has described the gametophyte generation of *Dictyota dichotoma*, dealing with the development of egg and sperm, fertilization, segmentation of the fertilized egg, and parthenogenesis. The oogonia and antheridia are developed simultaneously in fortnightly crops, each crop being initiated a little before the lowest neap tide, and reaching maturity about the period of the highest succeeding spring tide. A regular succession of crops continues thus from July to the end of October. The eggs are liberated for fertilization, and those not fertilized within half or three-quarters of an hour become invested by walls and give rise to parthenogenetic embryos. The oogonium and antheridium are produced by the increased growth of surface cells, and after cutting off a stalk-cell they form respectively a single egg and over 1500 sperms. All the divisions of the antheridium are homotypic, and there are sixteen chromosomes. The sperm has a lateral cilium, and there may be a second very much reduced cilium, but it is difficult to demonstrate. The eye-spot is very small, and instead of being at the base of the cilium is generally near the anterior end of the beak. After fertilization thirty-two chromosomes appear, and in the segmentation of the egg there is at first a single centrosome which divides, and as the two centrosomes separate the two spindle cones also diverge, until finally they form a normal spindle. In parthenogenesis the nucleolus breaks up into chromosomes, leaving no residual nucleolar matter to be extruded into the cytoplasm, as occurs in other mitoses. The mitotic figure is very irregular and multipolar; there is no nuclear membrane, and a cluster of nuclei is formed, each containing one or several chromosomes. These separate into two or more groups, and walls are formed between them. The process may go on a little further, but very soon it stops and the embryos die. Comparing normal germination with parthenogenesis, it is concluded that the entrance of the sperm into the egg causes a centrosome and radiations to appear in the cytoplasm, renders the metabolism of the nucleus far more active, introduces into the mitosis a directive influence that is completely absent from the parthenogenetic figure, and prevents the early disappearance of the nuclear membrane.—J. M. C.

MASSEE[30] has published an extremely interesting and suggestive paper on the origin of parasitism in fungi. The author refers to the experiments of Pfeffer and of Miyoshi on chemotaxis, and then shows by his own experiments that the germ tubes of parasitic fungi in general are attracted by decoctions of their respective host plants. Thus *Macrosporium Tomato* and *Cladosporium fulvum* are attracted by decoctions of tomato leaves, *Cercospora melonis* is attracted by a decoction of cucumber leaves, etc. Obligate parasites are attracted only by the cell sap of the plants upon which they are

[29] WILLIAMS, J. LLOYD, Studies in the Dictyotaceae. II. The cytology of the gametophyte generation. Annals of Botany **18**: 183–204. *pls. 12–14.* 1904.

[30] MASSEE, G., On the origin of parasitism of fungi. Phil. Trans. Roy. Soc. London B. **197**: 7–24. 1904.

parasitic; while facultative parasites are attracted by substances, such as sugar, common to many plants. That a facultative parasite does not attack all plants containing sugar is probably due to the presence of some other negatively chemotactic substance in the plant. A state of immunity, therefore, is determined by the presence or absence of chemotactic substance. This was actually shown to be the case with an immune cucumber plant growing among a number of plants attacked by *Dendryphium comosum*. All efforts to inoculate this plant failed. The germ tubes of the fungus also failed to respond chemotactically to a decoction of the leaves of the plant. Miyoshi has shown that by injecting leaves with a sugar solution the germ tubes of *Penicillium glaucum* could be made to penetrate the leaf and grow in its tissues. By a similar method Massee has succeeded in growing *Trichothecium candidum* on begonia leaves injected with 2 per cent. sugar solution. The spores produced in the first instance were sown on another injected leaf and so on for fifteen generations. Sowings from some of the later generations of spores were made on leaves not injected, and it was found that the fungus grew and fruited on the leaf; in other words, it had been changed into a true parasite in twelve to fifteen generations. In several other instances similar experiments were successfully carried out with other fungi and other hosts, and several illustrations are given where a similar transition was observed in nature. The transition from a saprophytic to a parasitic mode of life is thus shown to take place with comparative ease. The possibility of wide application of the suggestion embodied in Massee's work will at once appear evident, not only in its relation to parasitism among fungi, but also as an explanation of the curious phenomena of heteroecism and symbiosis.—H. HASSELBRING.

STRASBURGER[31] has made a careful investigation of the origin of the embryo sac and development of the prothallium in *Taxus baccata*. The work was undertaken not with the expectation of making new discoveries, but rather in the hope of establishing a firmer basis for comparison with the problematical structures of the embryo sac of angiosperms. Each embryo sac mother-cell in Taxus is the inner cell of a row resulting from repeated divisions of an outer cell of the periblem of the nucellus. The sporogenous cells in the nucellus form a group of from three to five contiguous embryo sac mother-cells only slightly marked off from the surrounding tissue, which in a physiological sense may be designated as a tapetum. The mother-cells are formed in October and the winter is passed in this condition, but by the end of February they have elongated so that they are readily distinguishable. The spring of 1903, when the material was collected, was unusually early, so that the pollen was shed by the last of February, and about the same time

[31] STRASBURGER, EDUARD, Anlage des Embryosackes und Prothalliumbildung bei der Eibe nebst anschliessenden Erörterungen. Reprint from Festschrift zum siebzisten Geburtstage von Ernst Haeckel. pp. 1–18. *pls. 1–2*. Jena, Gustav Fischer. 1904.

divisions appeared in the embryo sac mother-cell. Cold weather followed and all stages of development in the nucellus were suspended until the end of April. The mother-cell gives rise to four megaspores arranged in a row, though other arrangements are sometimes found, due presumably to the shape of the mother-cell. The four megaspores correspond to the four microspores formed by a pollen mother-cell. Usually only one of the megaspore mother-cells reaches the synapsis stage. The mitotic figure at the first division of the mother-cell is plainly heterotypic and the number of chromosome pairs seems to be eight. The expected sixteen chromosomes were counted repeatedly in vegetative tissues, but a smaller number was sometimes found. The second division is homotypic. The lowest of the four megaspores is almost invariably the one to germinate, but any of the others may develop, and in one case two contiguous megaspores of one row were observed with several free nuclei. Frequently more than one megaspore in the nucellus may begin to develop. The mitotic figure at the first division in the germinating megaspore is heterotypic, and generally eight chromosomes could be counted. This number was also counted at the second division. When the eight-nucleate stage is reached the nuclei have begun to assume a peripheral position in the sac, but there is no polar grouping as in angiosperm sacs.

Strasburger calls attention to the fact that *Ceratozamia mexicana* also has eight to sixteen chromosomes, while other gymnosperms, so far as determined, have twelve and twenty-four. Many embryo sacs nearly filled with tissues were examined to see whether any nuclear fusions occurred which could be compared with the fusion of polar nuclei in embryo sacs, but no fusions were found. The archegonium initials appear as soon as the embryo sac is filled with tissue.

After discussing the development of prothallia and fertilization in Gnetum, the conclusion is reached that it is not possible to derive the embryo sac of angiosperms from that of Gnetum, the resemblances being only phylogenetic parallels. The densely staining areas in the embryo sac mother-cells of Casuarina and of various gymnosperms were studied in Taxus. Though denser, they have the same general structure as the trophoplasm. It is suggested that these structures may be useful in determining the position of Casuarina.

The nuclear fusions which initiate the formation of endosperm in angiosperms are not found in gymnosperms and show no indication of their origin. They are not to be regarded as sexual fusions, although, under some conditions, the fusion of sister nuclei may be a process of fertilization.—C. J. CHAMBERLAIN.